ERIC Document Resume	See Instruction Sheet	DATE OF RESUME 7/14/65	DATE RECEIVED

A. PUBLICATION DATA

1. ERIC NUMBER	2. ORIGINATOR CONTROL NO(S).	3. IDENTIFICATION NO.	DO NOT WRITE IN SPACE BELOW
ED000343	7077	N.A.	

4. AUTHOR(S):
Weaver, Herbert B.

5. TITLE OF DOCUMENT ABSTRACTED:
The Mathematical Proficiency of Students of Psychology

6. PUBLICATION TITLE:
Journal of Educational Research

7. EDITOR(S):
N.A.

8. PLACE OF ORIGIN
ORG.
ST. Univ. of Hawaii
CITY, STATE Honolulu, Hawaii
TELE. EXT.
INST/LOC CODE

9. PUBLISHER OR SOURCE
Dembar Publications
Madison, Wisconsin

10. VOL.	11. PAGES	12. MO./YR	13. TOTAL PP.
LI	261-270	Dec. 57	10

MICROFILM COPY AVAILABLE YES ☒ NO ☐

COPYRIGHT GRANTED YES ☒ NO ☐

COPYRIGHT RELEASE FILED YES ☒ NO ☐

TYPE OF REPORT
PROPOSAL ☐
IN-PROGRESS ☐
FINAL ☒
FOLLOW-UP ☐

OTHER ERIC REFERENCES:

ERIC SATELLITE CODE

B. INDEXING DATA

14. SUBJECT AREA

15. TYPE OF ENDEAVOR
experimental study

16. INDEXING TERMS (6-12)

experimental studies G-23		psychology P-24			
measurement O-12		curriculum R-53			
mathematics O-11		science Y-04		students Y-15	

17. ABSTRACT (MAX. 250 WORDS)

Results of measurement of mathematical proficiency of about 100 psychology students at University of Hawaii shows that majority of students who specialize in psychology, as well as those who take a more limited number of courses, appear to have unsatisfactory preparation in mathematics.

ERIC No.

18. SOURCE OF ABSTRACT

C. FUNDING DATA

19. SUPPORTING ORGANIZATION	20. DIVISION OR DEPT.	21. CONTRACT NO. / PROJECT NO.
	22. TOTAL COST OF PROJECT	
	23. DURATION OF PROJECT	U.S. Department of Health, Education, and Welfare Office of Education

ERIC Form 1

U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
Office of Education

This document has been reproduced exactly as received from the person or organization originating it. Points of view or opinions stated do not necessarily represent official Office of Education position or policy.

JOURNAL OF EDUCATIONAL RESEARCH
(Vol. 51 - December 1957)

THE MATHEMATICAL PROFICIENCY OF STUDENTS OF PSYCHOLOGY

HERBERT B. WEAVER
University of Hawaii

A PERENNIAL PROBLEM facing instructors in statistical techniques, psychometrics, experimental psychology, applied psychology and research procedures is the student inadequately prepared in mathematics. This paper is a report on the extent of the problem, and presents the results of the measurement of the mathematical proficiency of approximately a hundred students of psychology at the University of Hawaii.

Selection of Measuring Instrument

The measuring instrument used was the Iowa Placement Examination for Mathematics Training (Revised, Form A), and was chosen for the following reasons:

1. It emphasizes specific mathematical knowledge and skill as opposed to "reasoning ability" or "aptitude" in mathematics.
2. It has a wide variety and range of difficulty of items, with separate measurement in four basic areas: arithmetic, algebra, geometry and formulation.
3. It is a high school achievement test, which was the maximum difficulty level desired.
4. Except for Part 3, Geometry, it requires the actual solution of problems. Almost all current tests of mathematical proficiency, ironically, do not require that a problem be solved, but only that the correct solution be selected from a series of choices. Since it was desired to make an item analysis showing actual knowledge, a test free of the element of chance success was necessary.

Subjects and Procedure

The test was given to three upper-division classes in psychology—two in the undergraduate course in statistical techniques and one in applied psychology. Four groups of subjects were then distinguished as follows:

Group I: Thirty-one undergraduate psychology majors, all of whom were in the statistics classes taking the course as a required major course.

ED000343

Group II: Twenty-four undergraduate non-psychology majors in the statistics classes taking the course as an elective, consisting of 14 education majors, 4 sociology, 3 English, 2 mathematics, and 1 government.

Group III: Eleven graduate students in the statistics classes taking the course as a required one, including students from the departments of psychology, education, speech and bacteriology.

Group IV: Thirty undergraduate students in the applied psychology class, representing a scattering of colleges and curricula, none of them having a major interest in psychology.

Since the purpose of the study was to survey the mathematical knowledge of the student groups rather than to measure individual differences, the element of speed was eliminated by disregarding the ten-minute time limits on the subtests. Each student was allowed to work as long as he wished and was encouraged to continue working as long as he thought he could solve additional problems. All finished within two hours. The test was thus a power test, and the results presumably represent all problems that each student could do regardless of time.

Analysis of Results

For each item and each subject-group the number and percent of the group solving the item were determined. Since Part 3 of the test, Geometry, permitted chance success, and since geometry is of relatively lesser importance in psychological statistics, Part 3 was disregarded.

Table I presents the percentage of each group correctly answering the twenty items comprising Part 1, Arithmetic. Table II presents similar percentages for the twenty algebra items comprising Part 2, and Table III the percentages for the fifteen formulation items, Part 4.

These results were then classified on the following basis: If an item was correctly answered by 75% or more of a group, the group as an instructional unit was classified as "adequately prepared" so far as the mathematical knowledge represented by the item is concerned. If from 50% to 74% inclusive of the group correctly solved the item, the group was classified as "poorly prepared." If from 25% to 49% inclusive of the group solved the item, the group was classified as "seriously deficient" on the item, and if 24% or less got it right, as "innumerate" or mathematically illiterate for instructional purposes. These are relatively conservative definitions and mean that more than one-fourth of the group had to fail an item before the group was called "poorly prepared" on knowledge represented by that item, and more than one-half had to fail an item before the group was called "seriously deficient." Failure by more than three-fourths of the group represents very serious deficiency or "innumeracy." Tables IV, V and VI present this classification of results.

To show the relative performance of the groups, the total score on the 55 items of the 3 parts studied was computed. The frequency distribution and the mean score for each group are shown in Table VII

Discussion

Since the test used consists of items of high school proficiency only, and

ED 000 243

TABLE I

PERCENTAGE OF EACH SUBJECT-GROUP CORRECTLY ANSWERING EACH ARITHMETIC ITEM

Item	Group I Undergraduate Psychology Majors N = 31	Group II Undergraduate Non-psychology Majors Studying Statistics N = 24	Group III Graduate Students Studying Statistics N = 11	Group IV Undergraduate Students of Applied Psychology N = 30
1	58%	88%	64%	63%
2	55	83	45	60
3	74	83	73	77
4	81	92	91	60
5	84	100	82	80
6	74	92	73	67
7	74	83	82	77
8	61	75	64	80
9	77	75	73	77
10	61	58	64	37
11	65	83	73	67
12	42	62	55	17
13	84	100	82	97
14	29	54	55	2[illegible]
15	32	50	64	33
16	29	71	36	40
17	65	71	55	30
18	35	50	64	27
19	23	50	64	13
20	19	75	45	33

TABLE II

PERCENTAGE OF EACH SUBJECT-GROUP CORRECTLY ANSWERING EACH ALGEBRA ITEM

Item	Group I Undergraduate Psychology Majors N = 31	Group II Undergraduate Non-psychology Majors Studying Statistics N = 24	Group III Graduate Students Studying Statistics N = 11	Group IV Undergraduate Students of Applied Psychology N = 30
1	55%	88%	82%	47%
2	26	58	27	33
3	52	67	55	20
4	42	46	36	13
5	52	79	55	27
6	71	75	73	50
7	65	79	36	50
8	52	54	45	20
9	39	54	64	23
10	19	46	36	10
11	6	42	27	7
12	6	33	36	7
13	61	79	73	47
14	39	58	27	20
15	13	42	27	0
16	16	38	27	7
17	3	21	9	0
18	13	46	27	7
19	10	29	27	3
20	3	42	9	0

TABLE III

PERCENTAGE OF EACH SUBJECT-GROUP CORRECTLY ANSWERING EACH FORMULATION ITEM

Item	Group I Undergraduate Psychology Majors N = 31	Group II Undergraduate Non-psychology Majors Studying Statistics N = 24	Group III Graduate Students Studying Statistics N = 11	Group IV Undergraduate Students of Applied Psychology N = 30
1	19%	50%	45%	17%
2	13	25	18	13
3	68	83	55	63
4	68	92	73	70
5	29	58	36	27
6	13	21	36	3
7	26	46	36	17
8	6	21	0	3
9	19	12	18	3
10	29	38	27	10
11	23	38	27	27
12	10	50	45	10
13	26	46	36	27
14	19	29	27	3
15	0	12	18	3

TABLE IV

PROFICIENCY OF THE SUBJECT-GROUPS ON THE ARITHMETIC ITEMS

Proficiency	Group I Undergraduate Psychology Majors	Group II Undergraduate Non-psychology Majors Studying Statistics	Group III Graduate Students Studying Statistics	Group IV Undergraduate Students of Applied Psychology
	Items:	Items:	Items:	Items:
Adequately Prepared	4,5,9,13	1,2,3,4, 5,6,7,8, 9,11,13,20	4,5,7,13	3,5,7,8, 9,13
Poorly Prepared	1,2,3,6, 7,8,10, 11,17	10,12,14,15, 16,17,18,19	1,3,6,8 9,10,11, 12,14,15, 17,18,19	1,2,4, 6,11
Seriously Deficient	12,14,15, 16,18	None	2,16,20	10,15,16, 17,18,20
"Innumerate"	19,20	None	None	12,14,19

TABLE V

PROFICIENCY OF THE SUBJECT-GROUPS ON THE ALGEBRA ITEMS

Proficiency	Group I Undergraduate Psychology Majors	Group II Undergraduate Non-psychology Majors Studying Statistics	Group III Graduate Students Studying Statistics	Group IV Undergraduate Students of Applied Psychology
	Items:	Items:	Items:	Items:
Adequately Prepared	None	1,5,6, 7,13	1	None
Poorly Prepared	1,3,5,6, 7,8,13	2,3,8, 9,14	3,5,6, 9,13	6,7
Seriously Deficient	2,4,9,14	4,10,11, 12,15,16, 18,19,20	2,4,7,8 10,11,12, 14,15,16, 18,19	1,2,5,13
"Innumerate"	10,11,12, 15,16,17, 18,19,20	17	17,20	3,4,8,9, 10,11,12, 14,15,16, 17,18,19,20

TABLE VI

PROFICIENCY OF THE SUBJECT-GROUPS ON THE FORMULATION ITEMS

Proficiency	Group I Undergraduate Psychology Majors	Group II Undergraduate Non-psychology Majors Studying Statistics	Group III Graduate Students Studying Statistics	Group IV Undergraduate Students of Applied Psychology
	Items:	Items:	Items:	Items:
Adequately Prepared	None	3,4	None	None
Poorly Prepared	3,4	1,5,12	3,4	3,4
Seriously Deficient	5,7,10,13	2,7,10, 11,13,14	1,5,6,7, 10,11,12, 13,14	5,11,13
"Innumerate"	1,2,6,8, 9,11,12, 14,15	6,8,9,15	2,8,9,15	1,2,6,7, 8,9,10, 12,14,15

TABLE VII

RELATIVE PERFORMANCE OF THE SUBJECT-GROUPS:
TOTAL SCORE ON PARTS 1, 2, AND 4

Total Score On Parts 1, 2, and 4	Group I Undergraduate Psychology Majors	Group II Undergraduate Non-psychology Majors Studying Statistics	Group III Graduate Students Studying Statistics	Group IV Undergraduate Students of Applied Psychology
50-54		4	1	
45-49		3	1	
40-44	1	1		
35-39	4	3	1	2
30-34	1	2	1	2
25-29	3	3	2	1
20-24	8	3	1	4
15-19	6	1		9
10-14	4	4	2	9
5-9	4		2	3
N	31	24	11	30
Mean	21.4	32.2	26.1	17.4

since it was used as a power test, the picture of the mathematical proficiency of these upper-division university students in not a pleasing one, especially when judged from the above standards.

In the group of thirty-one undergraduate students specializing in psychology, of the 55 test items analyzed, 75% of the group respond correctly to only four of the items, all of them arithmetic items. On 33 items more than half the group lacked the proficiency to solve the problems correctly. The best performance occurred on the arithmetic items, next algebra, and poorest formulation. In terms of total score on the 55 items, the average of the group was 21.4, despite the unlimited time allowed.

The picture among the graduate students was scarcely better. The students of applied psychology were the poorest. The undergraduates who elected the the statistics course gave the best performance.

It would appear that the great majority of students who specialize in psychology as well as those who take a more limited number of courses have an unsatisfactory preparation in mathematics. With the trend toward greater quantification in psychology, the need for mathematical sophistication on the part of the serious student increases.

Conclusions and Recommendations

1. The majority of students who specialize in psychology as well as those who take a more limited number of courses would appear to have an unsatisfactory preparation in mathematics.

2. Steps should be taken to encourage the serious student of psychological science to acquire an adequate mathematical background.

3. Educators and parents should make a continuing and thoughtful appraisal and reappraisal of whatever it is that happens to students in their pre-college educational careers that in so many cases blights them mathematically and frightens them of numbers.